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Efficacy of the EZJECT® lance for releasing red oak from sugar maple competition

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Background

Sugar maple (*Acer saccharum* Marsh.) often dominates regeneration in hardwood forests of central Ontario, and tends to exclude other desirable, less shade tolerant tree species. Red oak (*Quercus rubra* L.) is a mid-tolerant species that is highly desired for wildlife and biodiversity values, as well as for quality forest products, and is often suppressed by sugar maple. Red oak abundance has decreased in North American forests since aggressive fire suppression began (Shumway et al. 2001). Low intensity ground fires allowed oak to thrive while controlling more competitive species, including sugar maple (Kruger and Reich 1997). Where natural or prescribed fire cannot be used to control competing hardwoods, alternative methods for releasing red oak are required.

Mechanical or chemical release methods can be used as a substitute for fire to ensure that red oak seedlings will survive and reach maturity with good form and vigour. Potential release methods include cutting and herbicide applications. Herbicides are used to minimize aggressive resprouting that usually occurs after cutting competitive species (Lund-Hoie 1985, McLaughlan et al. 1996). The EZJECT® capsule injection system is a chemical control method that uses glyphosate herbicide [*N*-(phosphonomethyl) glycine at 0.15 g a.i. (active ingredient) per capsule, present as isopropylamine salt].

Photo by S. McPherson

Figure 1. *EZJECT® applications can occur in December, providing snow depth does not interfere with reaching the base of the tree and wood is not frozen.*

The EZJECT® lance is an appealing tool because it uses minimal amounts of herbicide (a high application rate in dense stands may require 5,000 capsules per ha, equating to 0.75 kg a.i./ha), it is quiet and easy to use, and it minimizes worker exposure to minimal levels of herbicide (Desrochers and Golsse 1994). Injection is accomplished by pressing the lance against the butt of the target tree (Figure 1).

The EZJECT® system has been shown to provide effective control of many species (e.g., poplar (*Populus* sp.) and birch (*Betula* sp.)) using glyphosate capsules[1], but maple control is difficult. The manufacturer (Monsanto) recommends late fall applications for controlling maple; however, resource managers prefer a more flexible and longer application season. A study was initiated in central Ontario to test the efficacy of seasonal EZJECT® treatments for controlling sugar maple of various diameters.

[1] Other herbicide capsules are not registered for use in Canada (e.g., triclopyr, picloram/2, 4-D, imazapyr, and hexazinone capsules are currently available in the United States).

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Methods

The study was established in 1992 in Anglesea Township, north of Tweed, Ontario. The experimental design consisted of 4 replicate blocks, with 12 sugar maple trees in each. The blocks contained 3 trees from each of 4 DBH (diameter at breast height) classes (0-5 cm, 5.1-10 cm, 10.1-15 cm, 15.1-20 cm). The canopy position of each treated tree (i.e., suppressed, intermediate, co-dominant) was also noted.

The seasonal treatments were: summer (June 25); early fall (September 16); late fall (December 9); plus a control (no application).

Capsules were injected evenly around the basal circumference of each sugar maple trunk at a rate of 1 capsule per 5 cm of DBH, as per product label recommendations (obtained from Monsanto in 1992). Since the manufacturer recommended that winter applications not occur when frozen wood could inhibit capsule penetration, early December was chosen for the late-season application.

The condition of each tree was evaluated 1, 2, and 3 years after treatment. A numerical *dieback* scale was used to characterize the extent of herbicide injury to the crown, based on a visual assessment (Table 1).

Table 1. *Crown dieback scale used to assess herbicide efficacy.*

Dieback scale	Amount of dead/ brown foliage	Description
0	0 %	Healthy, vigorous, no damage
1	1-5%	Minimal damage
2	6-10%	Minor damage
3	11-20%	Minor to moderate damage
4	21-40%	Moderate damage
5	41-60%	Moderate to severe damage
6	61-80%	Severe damage
7	81-99%	Very severe damage
8	100%	Dead

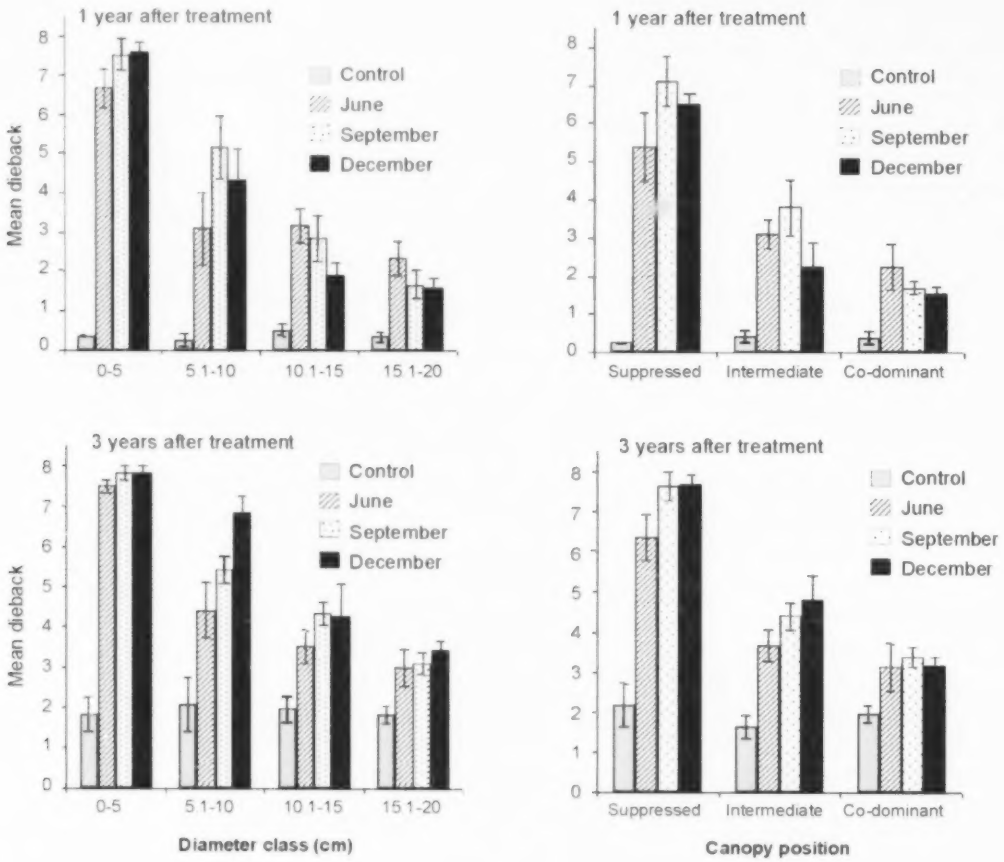

Figure 2. *Average crown dieback (based on scale in Table 1) of sugar maple stems, by diameter class and canopy position, 1 and 3 years after treatment with EZJECT® glyphosate capsules. Error bars indicate the standard error of each mean.*

Results and Discussion

Early effects of the summer treatment were visible after 1 month in the smallest diameter class (as wilting or browning), and 3 months after summer treatment in all diameter classes (although less than 20% dieback was apparent in the largest diameter class). The extent of crown dieback increased in all treated plots during consecutive years of assessment, especially for larger diameter stems (Figure 2). The manufacturer suggests 1 to 2 years are required for complete control, but data from this trial suggest that effects may extend beyond 2 seasons.

Treated stems in the smallest diameter class and suppressed canopy position had the most crown dieback (Figure 2). Efficacy, measured by crown dieback, apparently decreased as stem diameter increased. For the small, suppressed trees there appeared to be a seasonal treatment effect, evident 3 years after application as slightly less crown dieback for summer applications than for fall applications (Figure 2). In addition, higher incidences of mortality were observed for early and especially late fall applications by the third year of assessment (Figure 3). However, the highest mortality was less than 25% and mortality declined substantially as trees increased in size.

For trees greater than 10 cm in DBH, the summer application appeared to be more effective than the fall applications after the first year, but less effective after the third year (Figure 2). Data from the third season reflect higher crown dieback of stems greater than 5 cm in DBH that received the fall applications, although this trend decreased as stem size increased. Stems greater than 10 cm in DBH showed only moderate damage at best. Similarly, crown dieback of trees in intermediate and co-dominant canopy positions was low compared to smaller, suppressed trees. Furthermore, no mortality was evident in stems greater than 10 cm DBH by the third year of assessment (Figure 3). These results suggest that the recommended application rate is probably insufficient for larger diameter sugar maple. Quebec's Ministère des Ressources naturelles recommended 1 capsule per 4 cm of DBH for trees up to 12 cm DBH and 1 capsule per 3 cm of DBH for trees 14 cm DBH and larger (Desrochers and Golsse 1994). However, this rate exceeds current label recommendations and therefore cannot be recommended here.

Poor efficacy may also occur if capsule penetration of the cambium and phloem is inhibited on large trees with thick, corrugated bark. Injecting capsules into major roots close to the stem (after scraping away leaf litter) can provide better capsule placement where bark is generally thinner (R. Maki, Monsanto, pers. comm. 2002).

Some crown dieback also was evident in the untreated control plots, and was probably due to natural decline resulting from suppression from overtopping trees or perhaps drought and pests. No mortality was observed in the control plots.

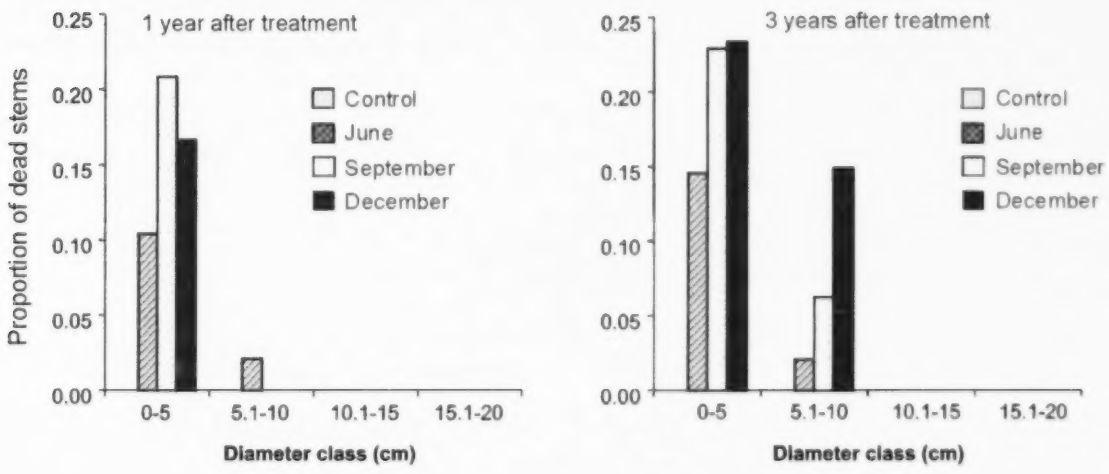

Figure 3. *Mortality of sugar maple 1 and 3 years after treatment with EZJECT® glyphosate capsules.*

Conclusions and Management Implications

Substantial crown dieback of sugar maple stems less than 10 cm in DBH was apparent 3 years after treatment with the EZJECT® capsule injection system. However, the highest level of maple mortality remained less than 25%. Results from seasonal treatments suggest that late fall treatments are most effective. The treatment window for EZJECT® applications could be extended to include early fall but control may be reduced. Summer appears to be the least effective treatment time. Late season applications should be planned to avoid deep snow and frozen wood.

Control of maple stems greater than 10 cm DBH was relatively low, regardless of the season of application. Alternative treatments may therefore be needed in stands with an abundance of larger maple stems. Release of suppressed red oak with the EZJECT® system may be effective if treatments are done in late fall in stands where competing sugar maples are mostly less than 10 cm DBH (i.e., during early stages of stand development before competing maples grow too large). In these circumstances, treatments will likely provide sufficient crown dieback and mortality of maples to provide a growth advantage to red oak. Alternatively, the EZJECT® system should be reserved for stands where the dominant competition consists of species that are more susceptible to glyphosate injection.

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